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CONFERENCE ON PROBLEMS OF CALCULATING MAXIMUM WATER DISCHARGES
IN PLANNING THE KUYBYSHEV, STALINGRAD, KAKHOVKA, AND
TSIMLYANSKAYA HYDROELECTRIC STATIONS

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A conference on problems of calculating maximum water discharges of the Volga, Don, and Dnepr rivers for the purpose of planning the Kuybyshev, Stalingrad, Tsimlyanskaya, and Kakhovka hydroelectric stations was held at the Academy of Sciences USSR from 3 to 5 July 1951, with Academician A. V. Vinter presiding. More than 100 representatives of academic, scientific research, planning and other organizations from cities including Moscow, Leningrad, Kiev, Kharkov, Minsk, and Tallin participated in the conference, which was called by the Committee for Cooperation in Large Construction Projects of Communism, under the Presidium of the Academy of Sciences USSR.

Academician A. V. Topchiyev in his opening remarks noted that the conference had been called for the purpose of submitting the highly important question of the maximum water discharges of the Volga, Dnepr, and Don rivers to wide discussion by the scientific and engineering community. He continued that the Committee for Cooperation had received from many organizations and private individuals a variety of proposals for perfecting hydrological calculation methods which should be discussed at the conference.

The following reports were heard. "Tasks of the Conference," by Ye. V. Bliznyak, Doctor of Technical Sciences, (Orgburo); "Calculation of Maximum Water Discharges of the Volga and Don Rivers in the Planning of the Kuybyshev, Stalingrad, and Tsimlyanskaya Hydroelectric Stations," by S. N. Kritskiy, Doctor of Technical Sciences, (Gidroyekt); "Calculation of the Maximum Water Discharge of the Dnepr in the Planning of the Kakhovka Hydroelectric Station," by Ya. I. Sakharovich (Ukrainian Branch of Gidroenergoprojekt); and "Forecasting the Factors of Spring Floods on the Volga and Dnepr" by G. P. Kalinin (Central Forecasting Institute).

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In discussion of the reports, the participants in the conference devoted most attention to the following problems: use of factual hydrological material; methods for adjusting calculated values of maximum water discharges; the possibility of reducing estimated values of maximum water discharges by compulsory emptying of reservoirs prior to spring floods on the basis of forecasts; and the effects of afforestation and progressive agricultural engineering on the magnitude of maximum water discharges.

As to the factual material used in planning, the data compiled from 70 years of hydrometering observations and to some extent from high water marks (on the Don and Dnepr) have been made the basis for determination of estimates of maximum water discharges of the Volga, Dnepr, and Don by the planning organizations. The conference noted that the high quality of the data on these rivers over a long period assured favorable conditions for making estimates. The conference further felt it necessary to recommend that the planning organizations conduct supplementary investigation of high water marks on the three rivers, that the Main Administration of the Hydrometeorological Service organize on a wide scale the collection and analysis of high water levels in the past, and that the results of these investigations be published.

The greatest discussion at the conference centered around the selection of a method for adjusting the estimates of maximum water discharges. As the speakers stated, maximum water discharges for the planning of hydroelectric stations were determined in accordance with GOST 2900-48.

Fundamental attention in this discussion was focused on the expediency of using binomial type curves of best fit (type III Pearson curves) in the calculations and on the desirability of calculating spillway openings on the basis of limiting, physically possible maximum water discharges. N. N. Chegodayev proposed a new type of curve of best fit, developed by him, which is limited at its upper part by the finite value of maximum water discharge. Chegodayev constructed his curve of best fit by incorporating many years' factual data on 15 rivers and a number of complex mathematical transformations into one statistical equation. Unfortunately, the discussion of the results of Chegodayev's work was hampered by a lack of experimental material which could verify the applicability of the proposal.

The conference listened with great interest to the figures calculated by G. I. Kalinin for the values of maximum discharges in the Volga, Dnepr, and Don by assuming the conditions of the most unfavorable meteorological conditions observed in the past (maximum rainfall and snowfall, absence of run-off losses, and highest flood peaks). Kalinin's figures were very close to the check figures used in planning which were calculated according to the GOST by curves of best fit with a guarantee correction factor.

Ye. V. Boldakov proposed that, in addition to calculation of structures on the basis of maximum water discharges determined by curves of best fit, a second calculation be made on the basis of the absolute maximum water discharge possible under the given climatic and geomorphological conditions. Boldakov's proposal, advanced in a general form without concrete practical recommendations, found little support among the majority of participants.

The gist of the discussion was that the conference approved the fundamental aspects of the methods for determining maximum water discharges which were adopted in the planning of hydroelectric stations.

Moreover, the conference noted that it was expedient in the estimation of maximum water discharges to carry out a joint analysis of both hydrological and meteorological conditions, as well as a study of the high floods on the Don in 1917, the Dnepr in 1931, and the Volga in 1926 and the publication of

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the respective monographs. The conference brought up the question of bringing GOST 3999-48 up to date. It was considered especially necessary to check the accuracy of norms of the probability of excess maximum water discharges, to standardize requirements proposed for determining how far the foundations of structures should extend above the water level in reservoirs, and also to include in the GOST instructions pertaining to calculation of the quantity of the maximum water discharges retained by reservoirs and, in this connection, instructions for the preparation of forecasts of high run-offs.

Considerable attention in the reports and during the discussion was devoted to the possibility of reducing maximum water discharges as a result of retention by reservoirs.

In the case of the Kuybyshev and Stalingrad hydroelectric stations the possibility arises that some part of maximum water discharges can be retained, as S. N. Kritskiy noted, by means of an increase in the head level of the reservoir, as was done in the engineering planning of the Kuybyshev Hydroelectric Station. However, the relatively long duration of the high water stage on the Volga and Don limits the effects of retention. Conditions are more favorable in this respect on the Dnepr, where, according to Ya. I. Sakharovich's report, assuming compulsory pre-flood emptying of the Kakhovka reservoir on the basis of a forecast 25-30 days in advance of the flood peak, preliminary calculations indicate the possibility of reducing by almost 30 percent the quantity of maximum water discharge, resulting in a substantial reduction of the cost of the whole hydroelectric station.

The conference recognized the expediency when determining the dimensions of spillways of taking into account both the storage capacity of the reservoir and the run-off forecasts. Forecasts are of the hydraulic type, e.g., based on predictions of the movement of water in river beds, and of the hydrometeorological type, based on the study of snowfall, snow melting conditions, etc. The latter type was considered usable to some extent if used with a definite degree of caution. The conference noted the need for further intensive investigation of forecasts to calculate their possible maximum errors.

The conference agreed that the preliminary scheme advanced for calculation of the retention of the maximum discharge by the Kakhovka reservoir was correct in principle; however, it was felt necessary to increase the accuracy of the basic elements of calculation, especially the form of the flood hydrograph and the magnitude of maximum error in the run-off forecast.

S. L. Venedikov's report was devoted to problems encountered in estimating the effect on the run-off of measures taken under the Stalin plan for the transformation of nature. He reported on the tendency, discovered by investigators, toward some decrease of the maximum water discharges of the Don as a result of reconstruction measures carried out in its basin.

The conference recommended that chief attention be directed at the study of the effects of tree and grass planting, etc., on high water and flood regimes.

Naturally, the discussion of problems relating to the calculation of maximum water discharges of the Volga, Dnepr, and Don touched on the question of what course the scientific investigations in hydrology should take in the future to satisfy the most important practical needs. Among the most important questions to which the conference referred were the shapes of high waters and floods, the relationships involved in the variation with time of factors shaping run-offs, the distribution of probabilities for river run-off magnitudes, the processes involved in the propagation of high water waves along river beds, and forecasts.

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The conference noted the great scientific research works on the estimation of maximum water discharges which were accomplished by Gidroproyekt, the State Hydrological Institute, Gidroenergoprojekt, the Central Forecasting Institute, Giprorrechtrans, and other scientific research institutes and planning organizations.

The conference demonstrated the breadth and variety of the scientific undertakings of the USSR hydrologists, which have raised USSR hydrological science to an unsurpassed level.

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